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*Priority*  
*Paper*  
*March*  
*6/19/01*

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant(s): Richard CROYLE  
Serial No.:  
Filed: March 12, 2001  
Title: TRANSCEIVER INTERFACE REDUCTION  
Group:

J1046 U.S. PTO  
09/803036  
03/12/01

LETTER CLAIMING RIGHT OF PRIORITY

Honorable Commissioner of  
Patents and Trademarks  
Washington, D.C. 20231

March 12, 2001

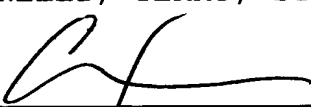
Sir:

Under the provisions of 35 USC 119 and 37 CFR 1.55, the applicant(s) hereby claim(s) the right of priority based on United Kingdom Patent Application No.(s) 0005890.9 filed March 10, 2000.

A certified copy of said United Kingdom Application is attached.

Respectfully submitted,

ANTONELLI, TERRY, STOUT & KRAUS, LLP

  
\_\_\_\_\_  
Carl I. Brundidge  
Registration No. 29,621

CIB/nac  
Attachment  
(703) 312-6600

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INVESTOR IN PEOPLE

The Patent Office  
Concept House  
Cardiff Road  
Newport  
South Wales  
NP10 8QQ



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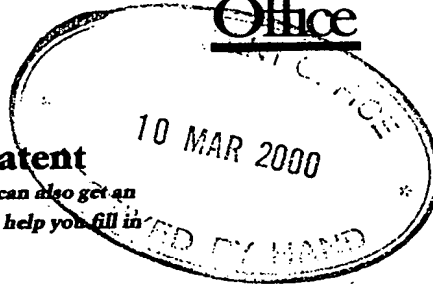
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**Request for grant of a patent**

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110 MAR 2000

The Patent Office

13MAR00 E520540-1 D02716

P01/7700 0.00-0005890

Cardiff Road

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Gwent NP9 1RH

1. Your reference

PAT 00003 GB

2. Patent application number

(The Patent Office will fill in this part)

**0005890.9**

3. Full name, address and postcode of the or of each applicant (underline all surnames)

NOKIA MOBILE PHONES LIMITED  
KEILALAH DENTIE 4  
02150 ESPOO  
FINLAND

Patents ADP number (if you know it)

5911995004  
FINLAND

If the applicant is a corporate body, give the country/state of its incorporation

4. Title of the invention

TRANSCEIVER INTERFACE REDUCTION

5. Name of your agent (if you have one)

"Address for service" in the United Kingdom to which all correspondence should be sent (including the postcode)

NOKIA IPR DEPARTMENT  
NOKIA HOUSE  
SUMMIT AVENUE  
FARNBOROUGH  
HAMPSHIRE  
GU14 0NG UK

7577638001

Patents ADP number (if you know it)

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Country

Priority application number  
(if you know it)

Date of filing  
(day / month / year)

7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

Number of earlier application

Date of filing  
(day / month / year)

8. Is a statement of inventorship and of right to grant of a patent required in support of this request? (Answer 'Yes' if:

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Continuation sheets of this form

Description

Claim(s)

Abstract

Drawing(s)

5 ✓

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1 ✓

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10. If you are also filing any of the following, state how many against each item.

Priority documents

Translations of priority documents

Statement of inventorship and right to grant of a patent (Patents Form 7/77)

Request for preliminary examination and search (Patents Form 9/77) 1

Request for substantive examination (Patents Form 10/77)

Any other documents (please specify)

11.

I/We request the grant of a patent on the basis of this application.

Signature

Haws

Date 9/3/00

HELEN HAWS, AGENT FOR THE APPLICANT

12. Name and daytime telephone number of person to contact in the United Kingdom

IAN JOHNSON 01252 865000

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Transceiver interface reduction

The present invention relates to a Serial Bus transceiver interface, particularly  
5 although not exclusively for use in a Universal Serial Bus (USB) device.

It is well known to employ a bus to carry signals within and between electronic  
devices. The definition of one such bus, the Universal Serial Bus (USB) is  
described in the following reference document – Universal Serial Bus  
10 Specification Revision 1.1 published by the USB Implementation Forum. The  
USB standard provides specifications for a host, a device and the cabling  
which links them. Amongst other requirements of the standard, a USB host  
must be capable of detecting the speed of those devices with which it is  
communicating. There are four possible such states as set out in the table of  
15 Figure 1 below.

The USB standard has become very popular with manufacturers of personal  
computers in particular. More recently and particularly with the expansion of  
the Internet, it is becoming more necessary for a computer to be connected,  
20 at least part of the time, to a telephone line to permit the transfer of data such  
as electronic mail. In the case of a laptop computer, it is often not convenient  
or possible to connect to a fixed telephone line. Thus, interfaces have been  
developed to allow a mobile telephone to be connected to a computer. Such  
interfaces can place severe demands on a lightweight battery-powered device  
25 such as a mobile telephone where considerations of size and complexity of  
circuitry together with power consumption are very important.

It is thus an aim of the present invention to seek to overcome the  
disadvantages of the prior art and further to reduce the complexity of a  
30 transceiver bus interface.

Thus, according to the invention, there is provided a transceiver interface connectable, in use, to a cable, the interface including an input for receiving a pair of signals from said cable, and a logic circuit connected to the input  
5 having a single logic output line, wherein the logic circuit has a first output state where both signals are below a predetermined level and a second output state where either or both signals exceed the predetermined level.

Preferably, the transceiver operates under the USB protocol in which case the  
10 interface may form part of a USB device which receives a pair of differential signals as inputs such that the first output state is indicative of a single ended zero state whilst the second output state is indicative of any other state of said differential signals. Conveniently, the logic means may be a NOR gate. The transceiver may form part of a USB device which may further include an  
15 application specific integrated circuit (ASIC) having a physical connection to said logic means via said logic line to facilitate the provision of the USB control protocol. The device may be included in a mobile telephone handset or the like to permit connection to a USB host or hub connected thereto. Where the device is included in a mobile telephone, the USB control functions  
20 might be added to the ASIC providing the telephone functions.

In order to aid in understanding the present invention, a particular embodiment thereof will now be described by way of example and with reference to the accompanying drawings, in which:

25

Figure 1 is a table setting out a requirement of the USB standard in relation to interfaces;

Figure 2 is a schematic view of a prior art USB topology;

Figure 3 is a diagrammatic view of a prior art USB cable;



Figure 4 is a partial circuit diagram of a prior art USB device mode interface showing the I/O interface section;

Figure 5 is a similar partial circuit diagram of an embodiment of a USB device mode interface according to the invention; and

- 5 Figure 6 is a block diagram of a mobile telephone handset incorporating the USB device mode interface of Figure 5.

In the following, a full description of the USB standard is omitted, it being understood that this forms part of the general knowledge of the skilled addressee. Referring to Figures 1 to 4, the table set out in Figure 1 highlights a requirement of the USB standard, namely that a host 1 must be able to determine the speed with which a device 2 connected to the host 1 is communicating via a USB cable 3. This state information is present as a differential signals carried on a pair of twisted pair conductors D+/D- 4,5  
10 housed within a shielded cable 3 which also contains power and ground conductors 7,8. Thus, a single ended zero state (Se0) is indicated if the voltage on both twisted pair conductors 4,5 is low; low speed operation of the device 2 is indicated by a low voltage on D+ 4 and a high voltage on D- 5; full speed operation of the device 2 is indicated by a high voltage on D+ 4 and a  
15 low voltage on D- 5; and a bus error is indicated by a high voltage on both D+ and D- 4,5.  
20

Referring in particular to Figure 4, a typical prior art USB device mode interface 9 has connections 10,11 to the twisted pair conductors D+/D- 4,5. In a receive mode, differential signals carried by the twisted pair cables of the USB cable 3 are received at the connections 10,11 and passed to an amplifier 12 which provides a logic output RCV 13 which is indicative of whether differential data is being received (RCV high) or not (RCV low) by the interface 9. In addition to the RCV output 13, differential signals received  
25 from the twisted pair conductors D+/D- 4,5 are translated by separate Schmitt  
30

triggers 14,15 into single ended logic output  $V_p$  and  $V_m$ . 16,17. Thus, the single ended output 16,17 can be used subsequently to determine in which of the four states set out in Figure 1 the USB is operating.

5 Turning to Figure 5, an embodiment of a USB device mode interface according to the invention is shown in which the RCV output 13 is determined in the same manner as described above in relation to the prior art circuit arrangement. However, the single ended circuit elements 14,15 of the prior art circuit are replaced by a single NOR gate 18 which receives as inputs  
10 19,20 the differential signals  $D^+$  and  $D^-$  14,15. Thus, the gate 18 provides a logic output  $Se0$  21 that is high if both  $D^+$  and  $D^-$  14,15 are low whilst any other combination of differential input signals results in the  $Se0$  logic output 21 being low. Thus, the interface is capable of determining the presence of the sole state relevant to a device under this portion of the USB standard.

15

It will be recognised by those skilled in the art that a device transceiver interface 9 does not operate in isolation but is required to permit the USB protocol to be employed by a logic device 2 when communicating with a USB host 1. As mentioned previously, details of the USB signalling protocol may  
20 be found in the USB reference – Universal Serial Bus Specification Revision 1.1. Typically, the instructions necessary to implement the protocol are held on an application specific integrated circuit ASIC, which communicates with the transceiver 9 via a set of tracks on a substrate (not shown) on which both components are mounted. Figure 6 shows in outline a mobile telephone  
25 handset 22 containing baseband and radio frequency (RF) portions 23,24. The baseband portion further contains an ASIC 25 which, amongst other functions, is provided with the functionality necessary to facilitate the operation of the handset 22 as a USB device when connected to a USB host 1. In this regard, it should be noted that the number of tracks required to  
30 connect the ASIC 25 to the USB interface 9 is reduced by one as a single  $Se0$

line replaces the  $V_p$  and  $V_m$  lines of the prior art interface. Furthermore, as a consequence of the reduction in the number of lines, both the ASIC 25 and the interface 9 require one less pin-out. In a non-illustrated variant of the above embodiment, an ASIC having the conventional number of pin-outs is connected to the USB interface. Whereas, in the prior art case where the  $V_p$  and  $V_m$  lines from an interface are connected to respective pins on the ASIC, one pin only on the ASIC is connected via the track to the USB interface 9 the other pin being tied in a high logic state.

10 Finally, those skilled in the art will recognise that the present invention is applicable not only to mobile telephone handsets but to any other device which can operate as a USB device such as printers, scanners and tape drives, for example. It will also be appreciated that the reference throughout the description to a USB host should be taken to include a hub whether self or  
15 bus powered.

Claims:

1. A transceiver interface connectable, in use, to a cable, the interface including an input for receiving a pair of signals from said cable, and a  
5 logic circuit connected to the input having a single logic output line, wherein the logic circuit has a first output state where both signals are below a predetermined level and a second output state where either or both signals exceed the predetermined level.
- 10 2. An interface as claimed in Claim 1, wherein the logic circuit is a NOR gate.
3. An interface as claimed in Claim 1 or Claim 2, wherein the first output  
15 state is indicative of a single ended zero state.
4. An interface as claimed in any preceding Claim, wherein the second  
output state is indicative of a non-single ended zero state.
5. A serial bus device including a transceiver interface as claimed in any  
20 one of Claims 1 to 4.
6. A device as claimed in Claim 5, wherein the device includes an  
application specific integrated circuit having a single physical  
connection to said logic output line.
- 25 7. A device as claimed in Claim 5 or Claim 6, wherein the bus is Universal  
Serial Bus.

8. A mobile radio telephone including a device as claimed in Claim 6 or Claim 7 as dependent therefrom, wherein the application specific integrated circuit also provides mobile telephony functions.
- 5 9. A transceiver interface connectable, in use, to a cable substantially as described herein with reference to Figure 5 and Figure 6 of the accompanying drawings.

Abstract

A transceiver interface (9) operating in accordance with the USB protocol includes a reduced number of pin outs by replacing the prior art logic pair of single ended outputs  $V_p$  and  $V_m$  (16,17) with a sole single ended zero output Se0 (21). The interface (9) is intended to form part of a USB device incorporated in apparatus such as a cellular radio telephone (22).

(Fig.5)

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D-	D-	State
0	0	Se0
0	1	Low speed detect
1	0	Full speed detect
1	1	Bus error

figure 1

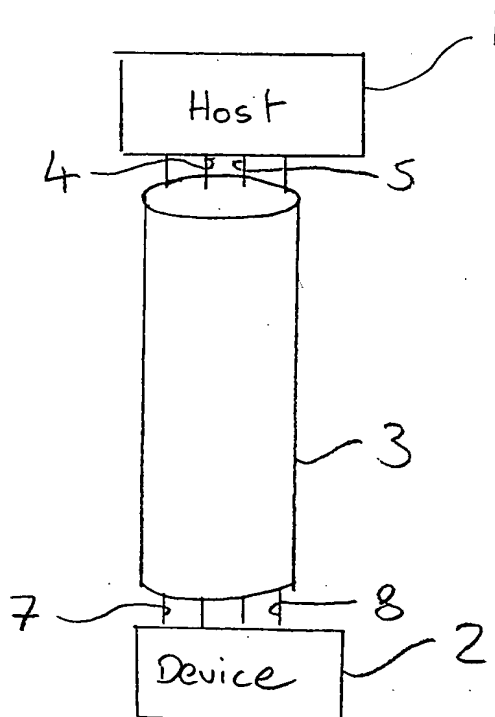
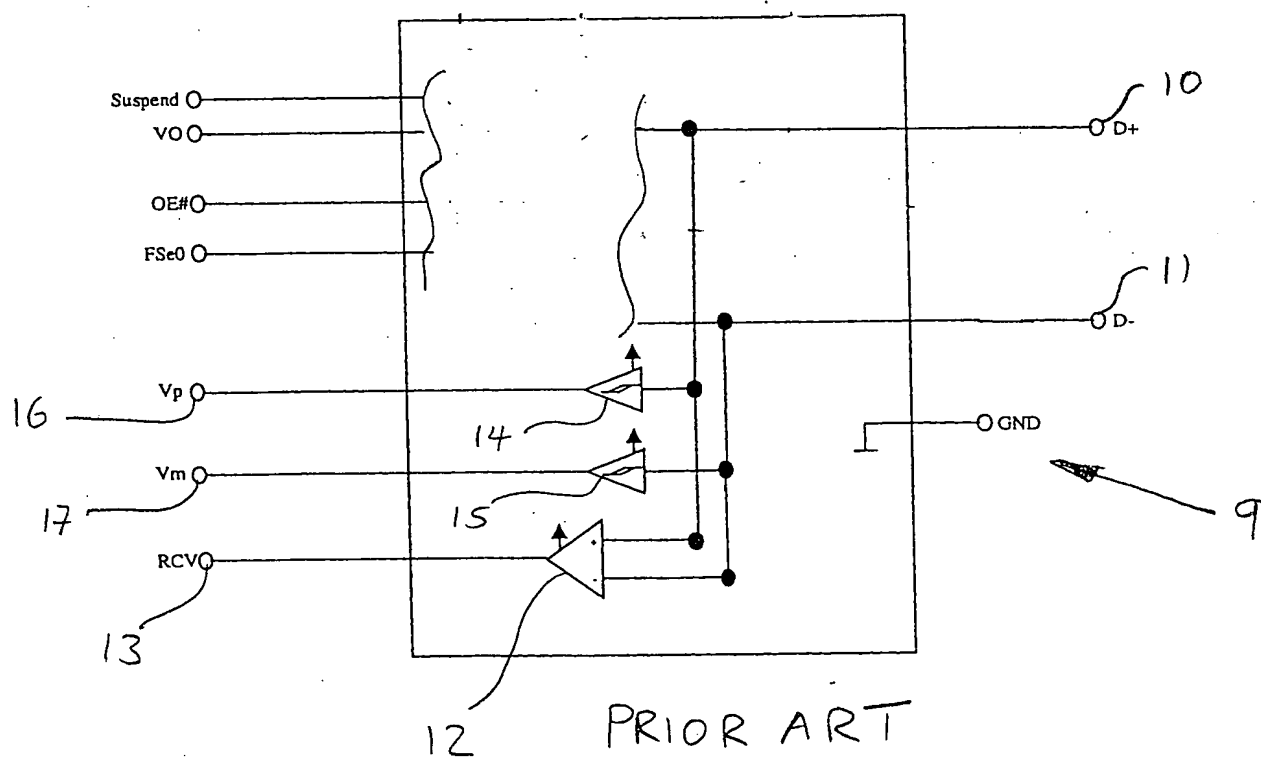
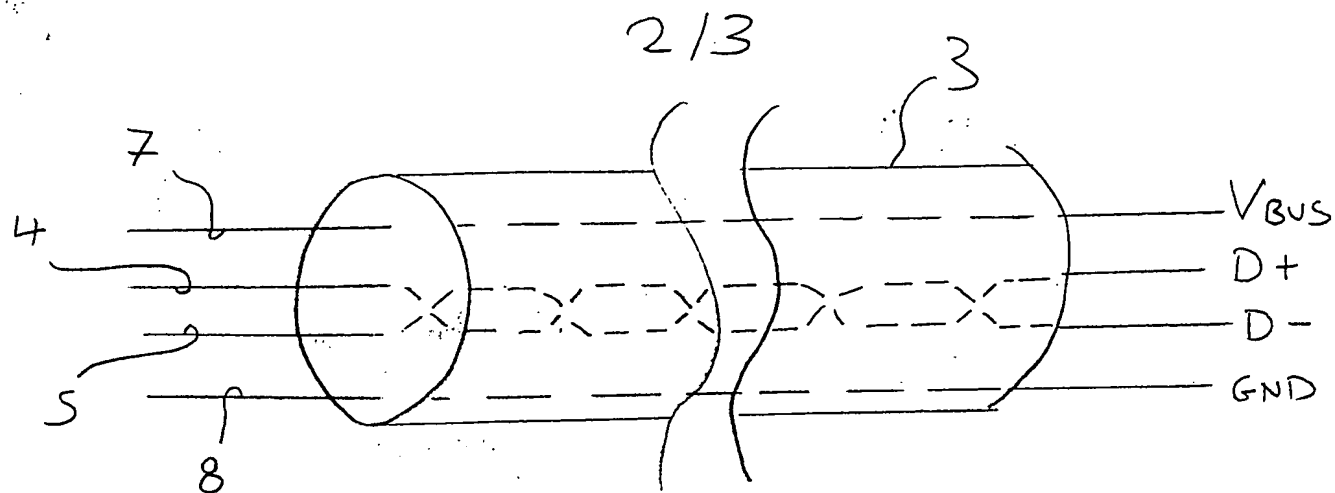


figure 2

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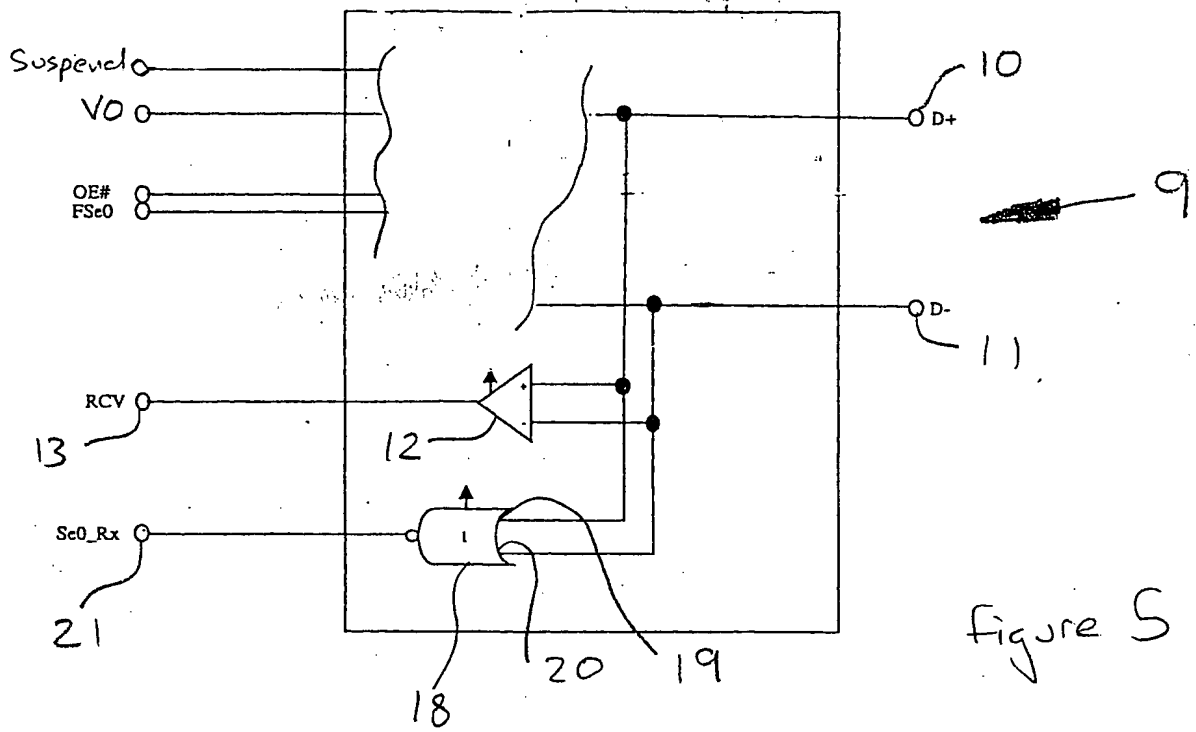


Figure 5

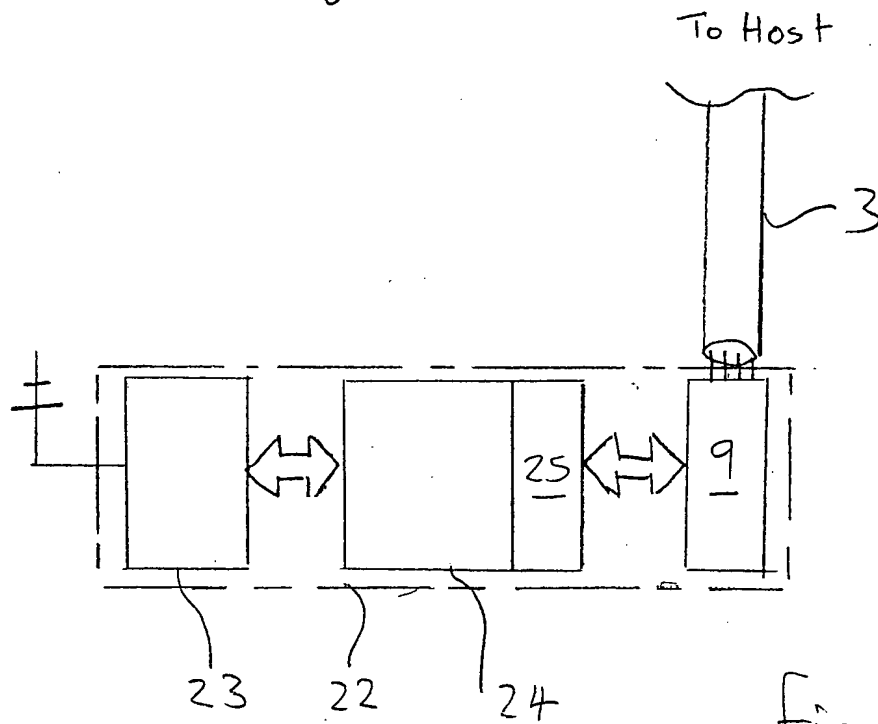


Figure 6

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